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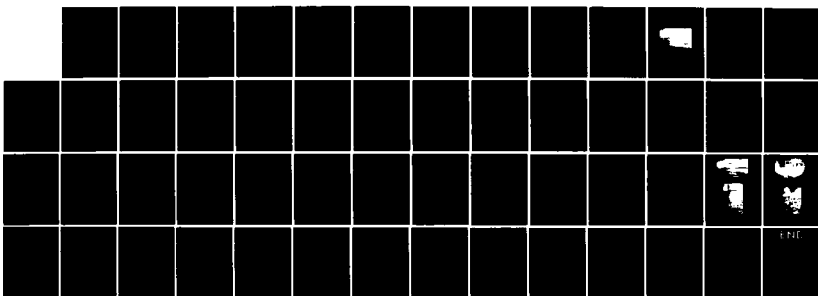
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
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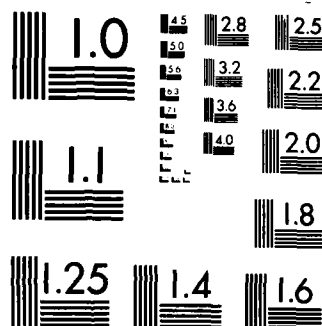
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AD-A155 118

MERRIMACK RIVER BASIN
HOPKINTON, MASSACHUSETTS

WHITEHALL RESERVOIR DAM

MA 00445

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

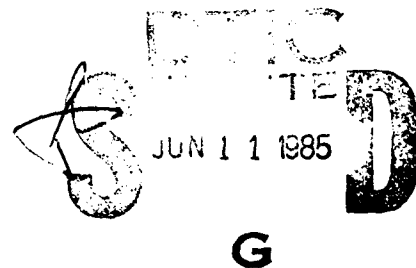
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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Merrimack River Basin Hopkinton, Massachusetts Whitehall Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is almost a 60-year old fill structure which has had added a concrete upstream face. The dam has no overflow spillway and the conduits, which once discharged water into the watercourse below the dam, are permanently closed. The dam appears to be in fair condition. It has an intermediate size classification and the hazard potential is significant. The owner should institute regular inspection and maintenance programs and make carious repairs.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 10 1978

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor Dukakis:

I am forwarding to you a copy of the Whitehall Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Department of Forests and Parks of the Commonwealth of Massachusetts, Hopkinton State Park, Route 85, Hopkinton, Massachusetts 01748.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

Incl
As stated

John P. Chandler
JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

WHITEHALL RESERVOIR DAM

MA 00445

MERRIMACK RIVER BASIN
HOPKINTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: MA 00445
Name of Dam: Whitehall Reservoir
Town: Hopkinton, Massachusetts
County and State: Middlesex County, Massachusetts
Stream: Whitehall Brook
Date of Inspection: June 13, 1978

BRIEF ASSESSMENT

The Whitehall Reservoir Dam is an almost 60-year old fill structure which has had added, in more recent times, a concrete upstream face. There are extensions at either end of the concrete face. A narrow road crosses the dam.

The dam has no overflow spillway and the outlet conduits, which once discharged water into the watercourse below the dam, are permanently closed. Water level in the reservoir is apparently maintained by means of a conduit which diverts water, up to its capacity, by gravity into a nearby pond. Discussions with past and present owners could not verify that this line is actually operating. The fact that the pond level is maintained suggests that it does operate.

Apparently, high flows are allowed to discharge over the dam and its extensions. The reservoir is part of Whitehall State Park and there are no dwellings close to its periphery. The dam has a drainage area of 4.92 square miles and impounds a reservoir of 570 acres.

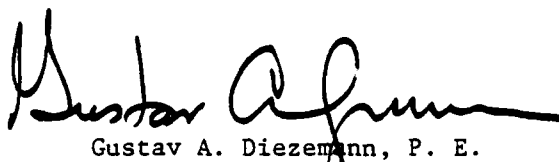
The dam and abutments appear to be in fair condition. However, the downstream slopes should be better maintained.

Owing to its impoundment storage, Whitehall Reservoir Dam falls within the intermediate size classification. It is in the significant hazard potential category and thus hydraulically analyzed using the full maximum probable flood.

Reservoir storage will reduce the probable maximum discharge of 3,495 cfs to a test flood of 2,625 cfs. As there is no overflow spillway, per se, such a flood would overtop the dam and its natural extensions to a height of about 3 feet. Houses downstream of the left abutment would be subject to flooding, but little damage and no loss of life.

The assumed failure of the dam produced an outflow of about double the test flood. This flow would overtop a highway 1,000 feet downstream of the dam by about 5 feet. This may cause flooding to a few homes and a firehouse adjacent to the highway, but no serious damage or loss of life would be expected. (The houses near the left abutment of the dam would not be affected.)

Additional investigations or major modifications are not required. The owner, however, should institute regular inspection and maintenance programs and make repairs as required, clear the watercourse immediately below the dam of growth and debris, fill eroded areas on the downstream slope, reactivate the outlet works, and develop a flood warning system.



Gustav A. Diezemann, P. E.
New York State Lic. 027062

This Phase I Inspection Report on the Whitehall Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens, Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

Str

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

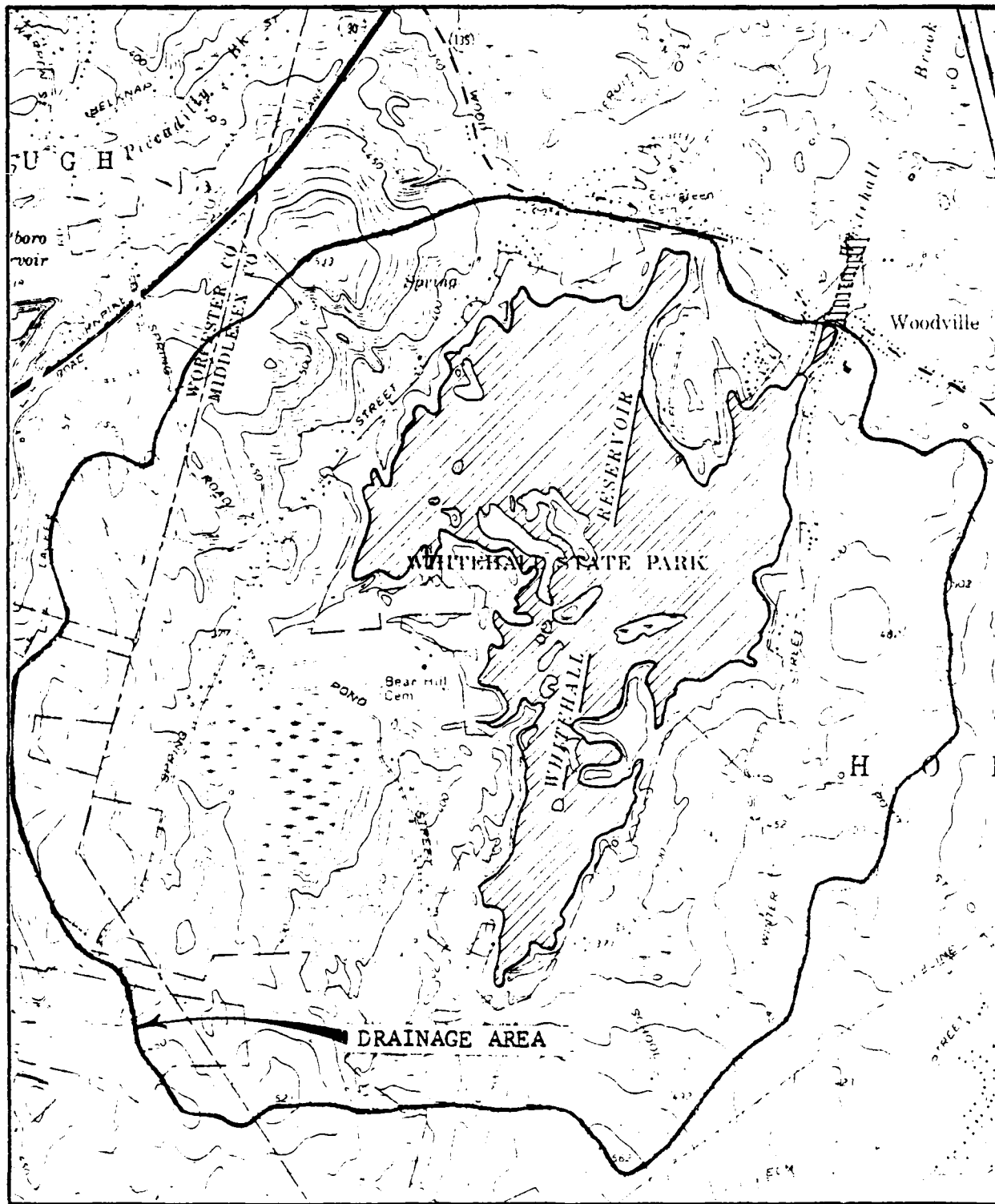
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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OVERVIEW PHOTO



WHITEHALL RESERVOIR

MILFORD, MASS.
Scale 1:24000

PHASE I INSPECTION REPORT

WHITEHALL RESERVOIR DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The Whitehall Reservoir on the Whitehall Brook is located in the Town of Hopkinton, Middlesex County, Massachusetts.

b. Description of Dam and Appurtenances. The dam is apparently an almost 60-year old fill structure abutting a masonry gatehouse. A narrow road crosses the dam. In more recent times, a concrete face, which appears to be vertical, was constructed on the upstream side and fill added. The structure blends into the abutting natural banks.

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

CT WHITEHALL RESERVOIR

DATE JUNE 13 1973

TIME 11:00 A.M.

WEATHER SUNNY & CLEAR

W.S. ELEV. 331 U.S. D.N.S

J. Goodrich

D. Fischer

L. Cross

PROJECT FEATURE

INSPECTED BY

REMARKS

APPENDIX A

As this dam has no spillway, per se, rehabilitation of the outlet works would not only furnish means of draining the reservoir, but would provide an additional aid in the safe operation of the reservoir. Reactivation of the outlet works would include making the control structure secure and the periodic testing of its operability.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Owing primarily to erosion on the downstream slope, this dam appears to be in only fair condition.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history, and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within one to two years of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations

Additional engineering investigations or major modifications to the dam are not required.

7.3 Remedial Measures

a. Alternatives. Not applicable.

b. Operation and Maintenance Procedures. The owner of the dam should develop and implement procedures which would include periodic inspection of the dam for signs of distress, deterioration, or vandalism. Repairs and restorations should be made where required. Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

Eroded areas on the downstream slope of the dam should be suitably filled. Removal of growth would serve no purpose but would, rather, provide an opportunity for damage by motorbikes or other destructive forces.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Nothing was noted which would indicate that the dam is unstable.

b. Design and Construction Data. No design nor construction data are known to exist.

c. Operating Records. Not applicable.

d. Post Construction Changes. No data concerning any post construction changes are known to exist.

e. Seismic Stability. The dam is located in Seismic Zone 2 and therefore a seismic analysis is not required according to the recommended guidelines.

(Rte. 135), and assuming the culvert plugged, the flood would flow over the road at a maximum water level of about El. 322 (approximately 5 feet over the road surface). Such a level could produce flooding at some of the low-lying homes, and possibly the firehouse, adjacent to the road. Downstream of Rte. 135, the channel widens and disperses into a flat, swampy area with no apparent low-lying properties in danger.

The areas of impace immediately downstream of the dam are shown on the location map.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations

This dam has no spillway. Any spill would overtop the dam and the natural abutments adjacent to it. It is not possible to determine exactly where the fill ends and the natural abutments begin. A total effective length, including 100 feet of concrete-faced dam, of 225 feet was assumed for hydraulic analysis. There is a small pond below the dam created by a highway fill. Flow from the pond passes into a marsh through a culvert under the highway.

d. Overtopping Potential

A Probable Maximum Flood (PMF) of 3,500 cfs was determined. Owing to the significant hazard potential and intermediate size classification, the PMF was used in the determination of the Peak Outflow (or test flood) of 2,625 cfs. Such a flood would overtop the dam and its natural extensions by about 3 feet. The downstream face of the dam may erode extensively in such a situation, but probably would not fail completely.

If a breach in the dam of 75 feet is assumed with the water level at the top of the dam, a Peak Failure Outflow of about 5,240 cfs would result. After filling the pond between the dam and Wood Street

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The water level in the pond is apparently maintained by a conduit which diverts water to a nearby pond. Excess flows would discharge over the dam.

4.2 Maintenance of Dam

There are apparently no regular maintenance procedures in effect, although the dam appears reasonably well maintained.

4.3 Maintenance of Operating Facilities

There is apparently no maintenance of the operating facilities.

4.4 Warning System

There is no warning system.

4.5 Evaluation

There appears to be a complete lack of regular operational procedures other than those described above. Recommendations for improving these conditions are given in Section 7.3.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The dam is in the Whitehall State Park and is part of this recreation area. There is no spillway, the original intent having been to release excess flows through a controlled outlet structure. The general appearance of the project can be described, in general, as fair.

b. Dam. The original dam has apparently been augmented by fill behind a retaining wall which, at a later date, was constructed as the new upstream face. There is a paved road on what is presumed to be the original section. The downstream face of the dam is heavily wooded and eroded in places. The dam is in fair condition.

c. Appurtenant Structures. The outlet structure is nailed shut. No effort was made to gain access. The exterior of the structure is in fair condition. Conduits in this structure discharge downstream of the dam into a short, rock-filled channel leading to a small impoundment. Presumably, there is another conduit controlled here which diverts water to a nearby pond.

d. Reservoir Area. The reservoir area is fairly flat and wooded. There are some houses on the periphery, but all seem to be well above the maximum water level attainable.

e. Downstream Channel. The small impoundment downstream of the dam is created by a road, Wood Street, across the channel. A culvert passes under the road into a large marsh in which there appears to be no habitation, although a gravel pit is indicated on the U.S.G.S. topographic maps.

3.2 Evaluation

The project is in fair condition and, while there are deficiencies which should be corrected, nothing was observed which would question the integrity of the structure. There is little property below the dam which would be endangered if the dam failed.

SECTION 2
ENGINEERING DATA

2.1 Design

No design data are known to exist according to the present owner and the Metropolitan District Commission.

2.2 Construction

The Whitehall Reservoir Dam was built in 1920 and improved in the 1950's. There are no detailed construction records available.

2.3 Operation

There are no operating data.

2.4 Evaluation

a. Availability. There are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound hydrologic and hydraulic engineering judgment.

c. Validity. The limited data available do not furnish a proper basis for a detailed evaluation of this dam.

g. Dam

(1)	Type	Fill, with concrete upstream wall
(2)	Length	100 \pm feet
(3)	Height	12 \pm feet
(4)	Top Width	20 \pm feet
(5)	Side slope	Unknown
(6)	Zoning	Unknown
(7)	Impervious core	Unknown
(8)	Cutoff	Unknown
(9)	Grout curtain	Unknown
(10)	Other	N/A

h. Spillway

(1)	Type	N/A
(2)	Length of weir	N/A
(3)	Crest elevation	N/A
(4)	Gates	N/A
(5)	U/S Channel	N/A
(6)	D/S Channel	N/A
(7)	General	N/A

i. Regulating Outlets. The outlets discharging into the watercourse downstream are inoperable and permanently closed. There is apparently an outlet conduit which diverts water into a nearby pond. The characteristics of this outlet could not be determined.

c. Elevation (Feet Above MSL)

(1)	Top of dam	El. 332 ±
(2)	Maximum design surcharge	El. 332 ±
(3)	Full flood control pool	N/A
(4)	Recreation pool	El. 331 ±
(5)	Spillway crest (gated)	N/A
(6)	Upstream portal invert diversion tunnel	N/A
(7)	Streambed at centerline of dam	El. 320 ±
(8)	Maximum tailwater	N/A

d. Reservoir

(1)	Length of maximum pool	10,000 ±
(2)	Length of recreation pool	10,000 ±
(3)	Length of flood control pool	N/A

e. Storage (Acre-Feet)

(1)	Recreation pool	3,400
(2)	Flood control pool	N/A
(3)	Design surcharge	4,000
(4)	Top of dam	4,000

f. Reservoir Surface (Acres)

(1)	Top of dam	587 ±
(2)	Maximum pool	587 ±
(3)	Flood control pool	N/A
(4)	Recreation pool	570 ±
(5)	Spillway crest	N/A

1.3 Pertinent Data

a. Drainage Area. The Whitehall Reservoir has a drainage area of about 4.92 square miles of semi-wooded, rural land.

b. Discharge at Damsite.

(1) The outlet works, consisting of three gated conduits, have been closed and are inoperable.

(2) The maximum flood at the damsite is unknown.

(3) There is no ungated spillway capacity.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

(6) There is no spillway capacity.

The gate structure, the door of which is nailed shut, houses gates to outlet conduits. Several calls to the present owner and to the Metropolitan District Commission (the former owner and operator), have failed to produce any definite information regarding the function of the sluices in the structure. It is believed that one connects to a conduit which diverts water from Whitehall Reservoir to what is known as the Duck Pond from which it flows by gravity to the Hopkinton Reservoir. The capacity of this conduit is unknown. As this is the only apparent means, other than spilling, of controlling the water level in Whitehall Reservoir, this conduit would be permanently open. There appear to be two other sluices which discharge downstream of the dam. These are inoperable and permanently closed.

The concrete face of the dam has an effective spillway length of about 100 feet. It is impossible to determine exactly where the fill sections end and the natural abutments begin. The fill or abutment sections, which will act as spillway extensions, are 25 and 100 feet long on the right and left banks, respectively.

c. Size Classification. Owing to its storage volume of about 3,400 acre feet, the dam falls within the intermediate size classification.

d. Hazard Classification. While there is no loss of life expected in the event of a failure of the dam, there could be appreciable economic loss in the event of a major flood. For analysis, significant hazard potential was assumed.

e. Ownership. The dam is owned by the Department of Forests and Parks of the Commonwealth of Massachusetts. It was owned formerly by the City of Boston.

f. Operator. Mr. John Pielczarski
Hopkinton State Park
Route 85, Hopkinton, Massachusetts
Office: (617) 435-4303. Home: (617) 934-3776

g. Purpose of Dam. The reservoir impounded by the dam is presently used for recreation purposes. It also furnishes water to Hopkinton Reservoir. It was formerly part of the water supply system of the City of Boston.

h. Design and Construction History. Other than it was originally constructed in 1920 and the concrete upstream walls added in the 1950's, nothing is known of the design and construction history of this dam.

i. Normal Operating Procedures. As far as can be determined, there are no operating procedures in effect.

INSPECTION CHECK LIST

PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u> (BEHIND concrete wing walls)	
Crest Elevation	334
Current Pool Elevation	331
Surface Cracks	None
Pavement Condition	-
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	O.K.
Horizontal Alignment	O.K.
Condition at Abutment and at Concrete Structures	O.K.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	-
Unusual Movement or Cracking at or near Toes	-
Unusual Embankment or Downstream Seepage	None
Piping or Boils	-
Foundation Drainage Features	-
Toe Drains	-
Instruments on System	

INSPECTION CHECK LIST

PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>CONCRETE DAM (WING WALLS)</u>	
Concrete Surfaces	<i>some spalling</i>
Structural Cracking	<i>none noticeable</i>
Movement -- Horizontal & Vertical Alignment	<i>none</i>
Junctions	<i>OK</i>
Drains -- Foundation, Joint, Face	<i>none</i>
Water Passages	<i>-</i>
Seepage or Leakage	<i>Leakage Through Gates</i>
Monolith Joints -- Construction Joints	<i>-</i>
Foundation	<i>-</i>

INSPECTION CHECK LIST	
PROJECT <u>WHITEHALL RESERVOIR</u>	DATE _____
PROJECT FEATURE _____	NAME _____

DATE _____

NAME _____

NOT
APPLICABLE

INSPECTION CHECK LIST

PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Concrete

Rust or Staining on Concrete

Spalling

Erosion or Cavitation

Cracking

Alignment of Monoliths

Alignment of Joints

Numbering of Monoliths

NOT
APPLICABLE

INSPECTION CHECK LIST

PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	<u>NOT</u>
Rust or Staining	<u>APPLICABLE</u>
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	
General Condition	
Loose Rock Overhanging Channel	<u>NONE</u>
Trees Overhanging Channel	<u>NONE</u>
Floor of Channel	
Other Obstructions	<u>Some vegetation</u>

INSPECTION CHECK LIST

PROJECT WHITE HALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER</u></p> <p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System</p>	<p><u>NOT</u></p> <p><u>APPLICABLE</u></p>

INSPECTION CHECK LIST

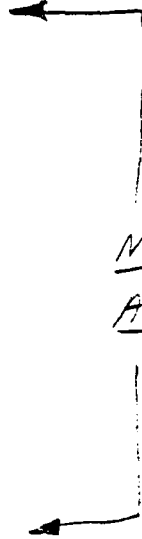
PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	



NOT
APPLICABLE

None

SOME VEGETATION IN CHANNEL

INSPECTION CHECK LIST

PROJECT WHITEHALL RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - SERVICE BRIDGE

a. Super Structure

Bearings

Anchor Bolts

Bridge Seat

Longitudinal Members

Under Side of Deck

Secondary Bracing

Deck

Drainage System

Railings

Expansion Joints

Paint

NOTAPPLICABLE

b. Abutment & Piers

General Condition of Concrete

Alignment of Abutment

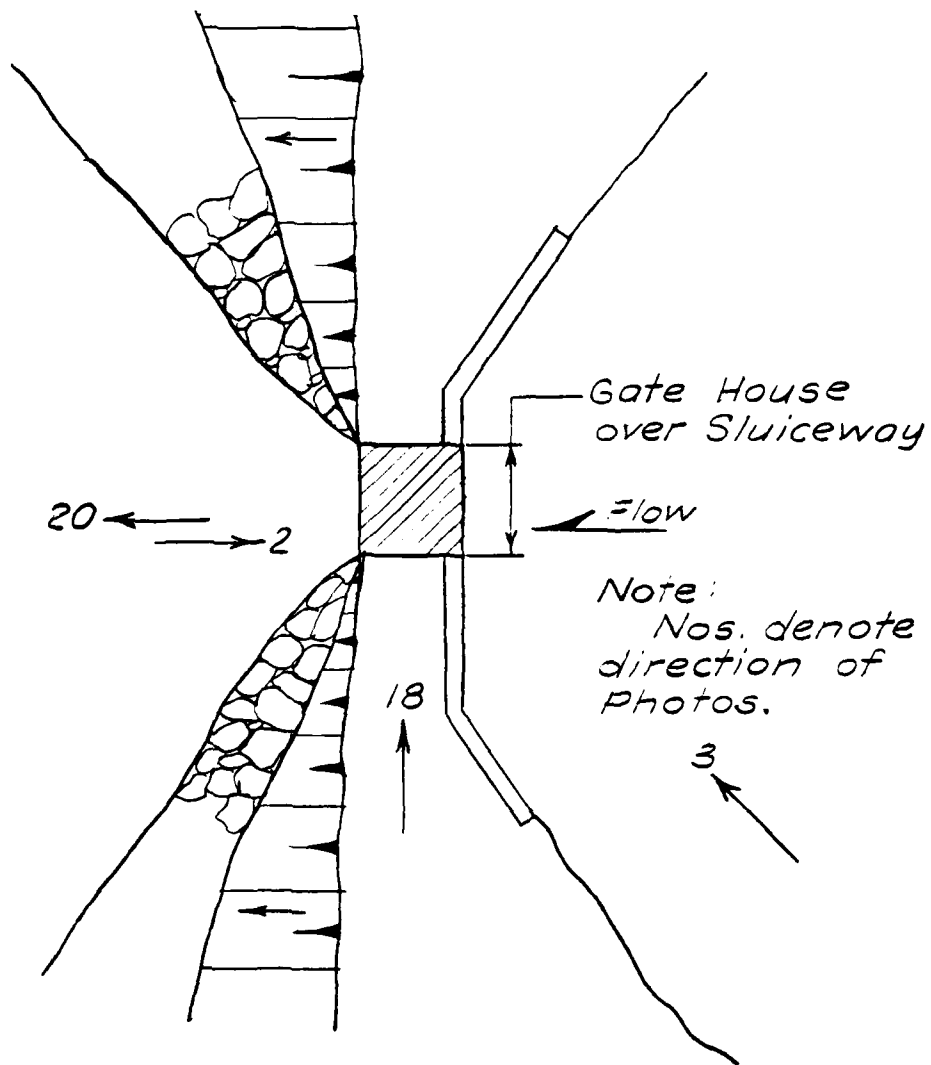
Approach to Bridge

Condition of Seat & Backwall

APPENDIX B

No records of the design and construction
of this project were located.

APPENDIX C



PLAN
WHITEHALL RESERVOIR



3

Upstream View of Dam



18

View along crest of Dam
from Left Bank

WHITEHALL RESERVOIR



2

View Looking Upstream at
Apron and Sluice Gate



20

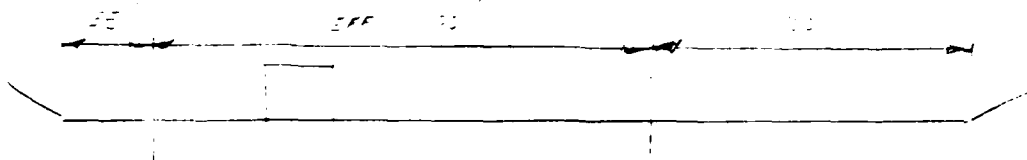
View Looking Downstream from
Discharge Apron

WHITEHALL RESERVOIR

APPENDIX D

Client C. H. J. Job No. _____ Sheet 1 of 1
 Subject _____ By _____ Date _____
 Ckd. _____ Rev. _____

PMF = 3495 = QP₁
 Res. Area = 570 AC
 D. A = 4.92 mi²



Factor C = 3.25

PMF	Q	Q - PMF
3495	1480	2015
3495	1480	2015
3495	1480	2015
3495	1480	2015
3495	1480	2015

calculations see page

POINT OVER DAM

Client C of E
Subject WHITEHALL RES

Job No. _____ Sheet 2 of _____
By J. VETCH Date 12 JULY 1978
Ckd. _____ Rev. _____

REACH #1.

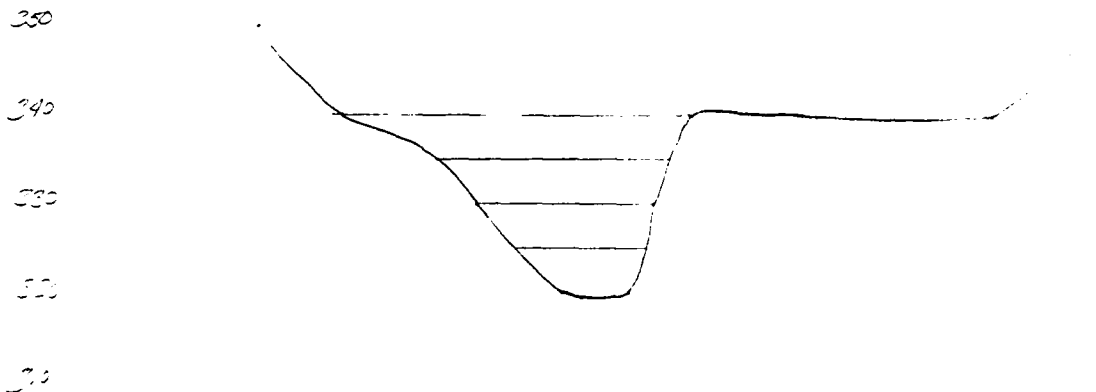
SECTION #1
JUST BELOW DAM

$$\text{SLOPE} = \frac{2}{700} = .013$$

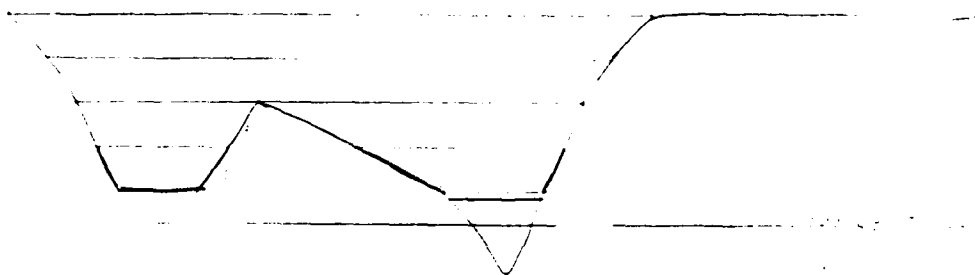
$n = .05$
 $C = 30$

SCALE $\frac{1}{20}'$ vert.
 $\frac{1}{500}'$ horiz.

L.D.



SECTION #2
700' below SECTION #1.



area needed

Client C O F E Job No. _____ Sheet 3 of _____
 Subject WHITEHALL RES By J. J. EITEN Date 15 JULY 1978
 Ckd. _____ Rev. _____

REACH #2

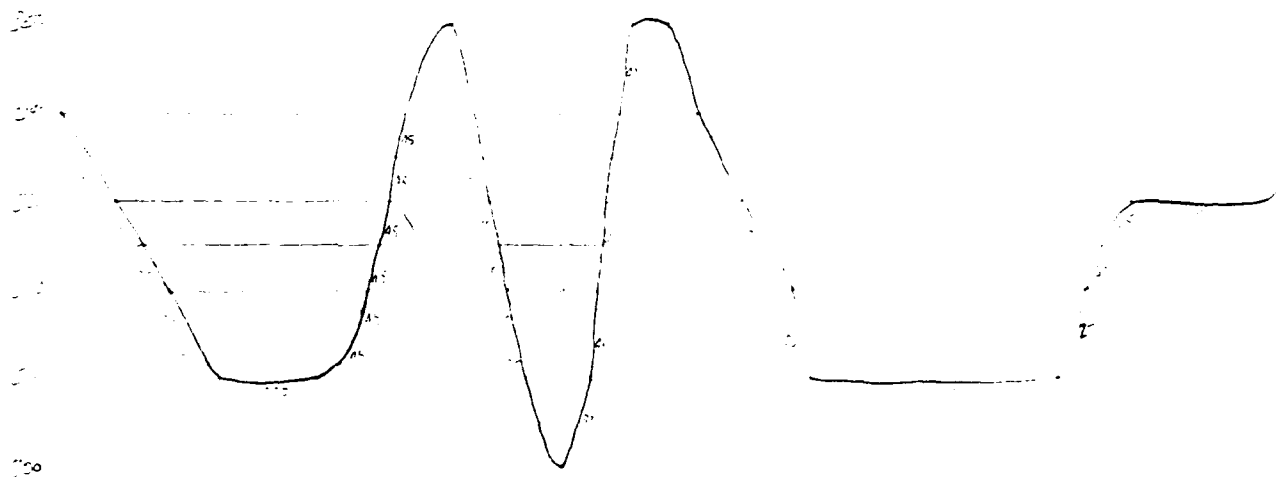
$$SLOPE = \frac{11}{500} = .022$$

$$n = .05$$

$$C = 30$$

SECTION #3

500' BELOW SECTION #2



SECTION #4

1000' BELOW SECTION #3

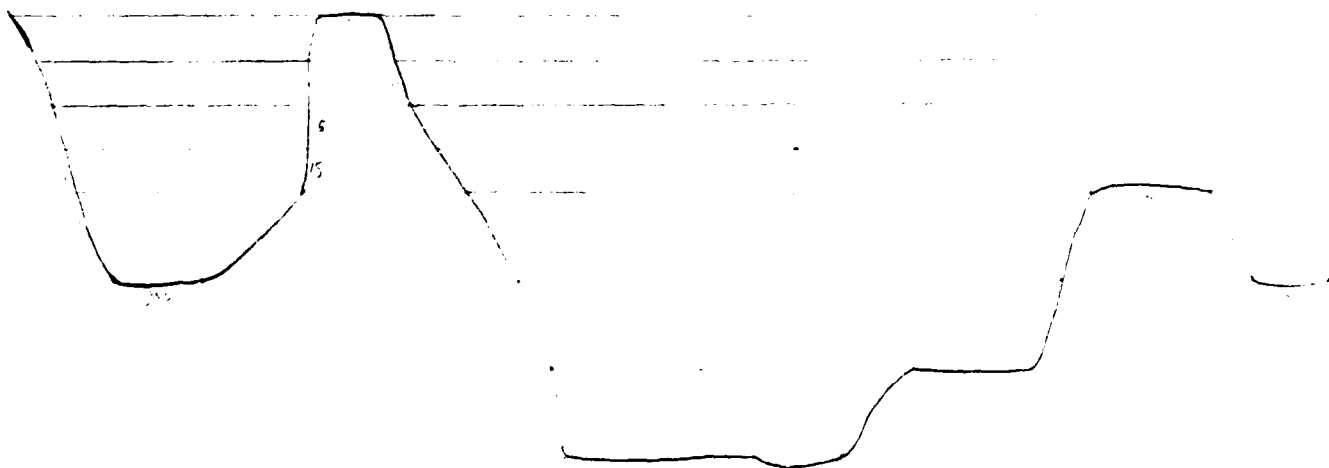
1" = 20' vert.
1" = 600' hor.

REACH #3

$$SLOPE = \frac{11}{1000} = .011$$

$$n = .05$$

$$C = 30$$



Client CCE Job No. _____ Sheet 4 of _____
 Subject WHITEHALL RES. By J. VEITCH Date 18 JULY 1978
 Ckd. _____ Rev. _____

AREA, WETTED D.

		A (FT) ²	Σ A	WP (FT)	Σ W.P.
SECTION ONE: EL.	320	—	—	185	185
	325	1425	1425	190	375
	330	2175	3600	190	565
	335	2875	6475	160	725
	340	4063	10538	265	990
TWO:	320	1380	1380	280	280
	325	3688	5068	680	960
	330	5925	10993	460	1420
	335	7538	18531	190	1610
	340	8475	27006	180	1790
THREE	320	15,125	15125	1575	1575
	325	8,825	23950	300	1875
	330	10,225	34175	305	2200
	335	13,425	47600	275	2475
	340	14,625	62225	275	2750
FOUR	320	60,240	60240	3320	3320
	325	19275	79515	575	3915
	330	20025	99540	195	4110
	335	20700	120240	165	4275
	340	21525	141765	200	4475

Client C of E
Subject WHITEHALL RES
- STAGE LIFTING -

Job No _____ Sheet 5 of _____
By J VETTER Date 18 JULY 1978
Ckd _____ Rev _____

REACH ①

$$\text{EL. 320} \quad Q = ACR^{2/3} S^{1/2} = 690(30) \left(\frac{610}{233} \right)^{2/3} (.013)^{1/2} = 4,970 \text{ CFS}$$

$$325 \quad Q = 3247(30) \left(\frac{3247}{563} \right)^{2/3} (.013)^{1/2} = 31,570 \text{ CFS}$$

$$330 \quad Q = 7297(30) \left(\frac{7297}{993} \right)^{2/3} (.013)^{1/2} = 94,340 \text{ CFS}$$

$$335 \quad Q = 12503(30) \left(\frac{12503}{1168} \right)^{2/3} (.013)^{1/2} = 207,725 \text{ CFS}$$

$$340 \quad Q = 18772(30) \left(\frac{18772}{1395} \right)^{2/3} (.013)^{1/2} = 363,270 \text{ CFS}$$

$$V_1 = \frac{1.1}{5} \frac{(3247)(700)}{43560} = 11.5 \text{ AC.FT}$$

$$Q_{P_2}(\text{TRIAL}) = Q_{P_1} \left(1 - \frac{V_1}{S} \right) = 8530 \left(1 - \frac{11.5}{8.57} \right) = 3530 \text{ CFS}$$

ASSUMING WORST CASE: $V_0 = 15.9 \Rightarrow S = 570(15.9)(.90) = 8157 \text{ AC.FT}$

NO STORAGE $Q_{P_1} = 8530 \text{ CFS} \quad @ \text{ EL. } 321.1 \text{ FT.}$

Client C. OF E

Job No. _____

Sheet 6 of _____

Subject WHITE HALL RES

By J. B. E. H.

Date 15 JULY 1979

Ckd. _____

Rev. _____

ELEV. (FT)

25

30

35

40

45

50

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100

G (CFS x 10³)

REACH 1



Client COFE

Job No. _____

Sheet 7 of _____Subject WHITEHALL RES.By J. VEITCHDate 19 JULY 1978

Ckd. _____

Rev. _____

REACH *2.

Q_{P1} = 8530 CFS

EL. 320

$$Q = (8253)(30) \left(\frac{8253}{938} \right)^{2/3} (.022)^{1/2} = 156,513 \text{ CFS}$$

SLOPE = .022

n = .05

C = 30

$$325 \quad Q = (14509)(30) \left(\frac{14509}{1123} \right)^{2/3} (.022)^{1/2} = 302,960 \text{ CFS}$$

330

335

Client _____ Job No. _____ Sheet 9 of _____
 Subject _____ By _____ Date _____
 Ckd. _____ Rev. _____

WINDING ROAD BRIDGE

BRIDGE LITIGATION

$$\frac{5240}{\sqrt{12}} = \frac{5240}{3.464} = 1512.4$$
 (USE $Y_0 = 12'$)

BRIDGE LITIGATION

$$5240 - 322.1 = 4917.9$$

$$- 322.1 \left(\frac{5240}{322.1} \right)^{1/5} = 5240$$

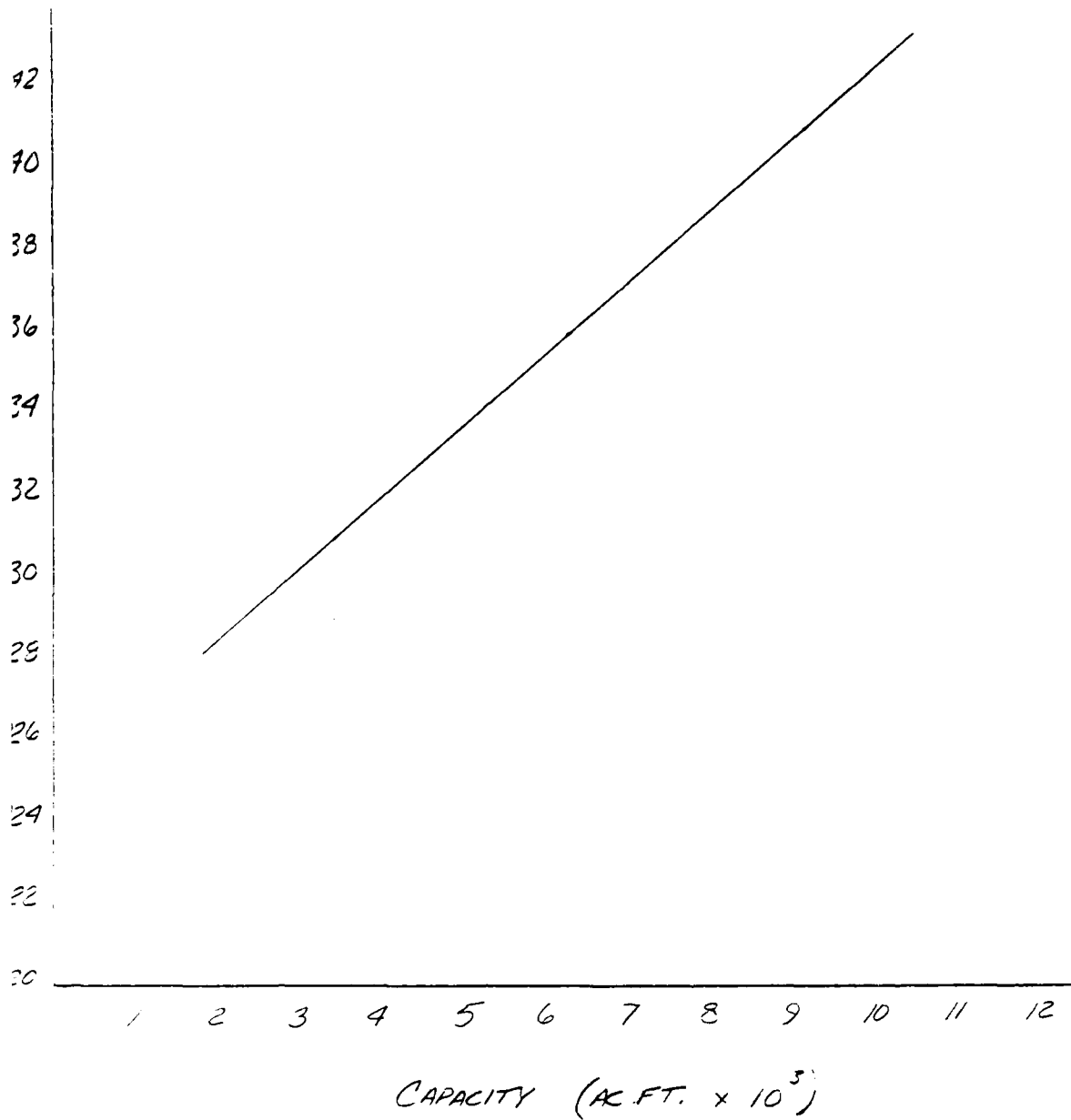
BRIDGE LITIGATION

$$5240 - 322.1 = 4917.9$$

$$- \frac{5240}{322.1} = 5.1'$$

BRIDGE LITIGATION

1 C of E Job No. _____ Sheet _____ of _____
ct - WHITEHALL - By J. VEITCH Date 22 Aug. 1978
CAPACITY CURVE Ckd. _____ Rev. _____



APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

END

FILMED

7-85

DTIC